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The Effects of Exposure to Attractive and Unattractive Infant Faces on Self-Reported and Psychophysiological Affect

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by

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Dedication

For Howard Schein, Deborah Allen, and Zoe Schein, who taught me from the beginning that complexity should be embraced rather than eschewed.

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The Effects of Exposure to Attractive and Unattractive Infant Faces on Self-Reported and Psychophysiological Affect

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The University of Texas at Austin, 2016

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Abstract: The primary aim of this study was to determine the trajectory of self-reported liking ratings and psychophysiological affective responses to attractive and unattractive infant stimuli over multiple exposures to determine whether these trajectories would conform to the predictions of mere exposure theory or negativity bias. Participants viewed a block of attractive and unattractive infant photographs, repeated 25 times, while their liking ratings and *corrugator supercilli, levator labii superioris,* and *zygomaticus major* muscle responses were recorded. Overall, self-reported liking ratings decreased as a function of exposure to the unattractive infant faces, indicating that repeated exposure intensifies the initial negative evaluation of those faces, rather than increasing liking for all stimuli.

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Chapter 1: Introduction

The mere exposure effect is a foundational theory of social psychology, and is applied in advertising, studies of decision-making, and explanations of human interaction (Zajonc, 1968). Although mere exposure theory posits that exposure to any stimulus is, in itself, a sufficient circumstance to cause an increase in attraction to the stimulus, I will argue that exposure applies differentially to attractive and unattractive faces.

In this paper I first describe the existing literature related to perceptions of attractiveness and the related biases that ensue based on facial attractiveness. I then review the literature about mere exposure theory, including how it relates to attractiveness and human interaction. I argue that mere exposure theory neglects to fully account for the effect of stimulus valence, including whether faces are initially perceived as attractive or unattractive. I then discuss ways in which perceptual fluency influences perceptions of familiarity and experiences of affect with regard to attractive and unattractive faces. Finally, I discuss how electromyography can be used to uncover affective responses and biases toward different types of stimuli and how it will be utilized in this study.

ATTRACTIVENESS

Overview of Literature

The facial attractiveness of a person affects raters' judgments of their social and academic/occupational competence. When adults make predictions about the personalities and life outcomes of others, they rate attractive people as being better adjusted, and more likely to have happy social lives and high-status careers (Dion, Berscheid, & Walster, 1972). These assumptions about the outcomes of attractive people are at least partially accurate: Attractive adults have better occupational success (Hosoda, Stone-Romero, & Coats, 2003), higher salaries (Hamermesh, 2011), and more upward financial mobility (Frieze, Olson, & Russell, 1991) compared to unattractive people (Ambady & Rosenthal, 1993).

Beyond that, treatment of both attractive adults and children is more positive: Perceivers provide more attention and more positive interaction toward attractive than toward unattractive targets. The differential judgment and treatment may in turn affect the traits and behaviors of the targets themselves: attractive adults and children are more popular, better adjusted, and more intelligent than their unattractive peers. They also have higher perceptions of their self-worth and competence (Langlois et al., 2000). Dion, Berscheid, and Walster (1972) characterized the attribution of positive qualities to attractive people as the "beauty-is-good" stereotype.

Interestingly, familiarity is not a significant moderator of perceptions of attractiveness: a meta-analysis found that the effects of attractiveness are strong whether or not the perceivers are acquainted with the targets (Langlois et al., 2000). People even judge their own twin sibling based on attractiveness, with both twins rating the more attractive twin to be higher in physical attractiveness, and more socially competent, emotionally stable, and athletic than the less attractive twin (Principe, Rosen, Taylor-Partridge, & Langlois, 2013).

In addition to the beauty-is-good stereotype, there may also be an ugly-is-bad stereotype: unattractive faces are perceived as less intelligent, social, and altruistic than medium and high attractive faces. The assumption that unattractive faces are associated with more negative attributes may be related to humans' tendency to pay more attention to negative information in faces (Oehman, Lundqvist, & Esteves, 2001) due to their potential threat or the false notion that unattractive people are less healthy (Kalick, Zebrowitz, Langlois, & Johnson, 1998).

Perceptions of Child and Infant Attractiveness

Adults are reliable and consistent judges of infant attractiveness (Corter et al., 1978; Langlois et al., 2000) and show increased attention toward attractive infants (Hildebrandt & Fitzgerald, 1978). When stimuli included "abnormal" infant faces, such as those with Down's syndrome, cleft palate, fetal alcohol syndrome, and skin disorders, adults generally increased the amount of time they spent viewing normal baby faces and decreased the amount of time they spent viewing abnormal infant faces (Yamamoto, Ariely, Chi, Langleben, & Elman, 2009). This finding does not clarify whether positive affective responses toward attractive infants or negative affective responses toward unattractive infants are the cause of the discrepancy of preference between the two groups.

Some studies have found evidence of the "beauty-is-good" stereotype with regard to child faces as well as adult faces: A general preference for attractive infant faces may influence adults' judgments about the infants' abilities and personal characteristics. When photographs of 3 and 9 month old infants were rated for attractiveness and evaluative traits, Stephan and Langlois (1984) found that the attractive infants were rated as smarter, more likeable, and "better babies" than the low attractive infants.

Other studies have found evidence to support the general "ugly-is-bad" stereotype: Adults hold negative biases and stereotypes about children low in attractiveness, even in domains unrelated to attractiveness, such as their traits and competencies (Dion, 1972, 1974; Ritter, Casey, & Langlois, 1991; Stephan & Langlois, 1984), and respond to unattractive infant faces with negative physiological affect (Schein & Langlois, 2015). Young children likewise show a negative bias toward their unattractive peers, and rate them as being unpopular and likely to display antisocial behavior (Dion & Berscheid, 1974).

Perceptions of attractiveness can also affect adults' behavior toward children. Dion (1972, 1974) has shown that instances of behavioral transgressions by unattractive children are treated more harshly than instances of those same behaviors by attractive children. In a 1972 study, Dion asked undergraduates to read about transgressions committed by children whose photographs were attractive versus unattractive. The raters claimed that the unattractive children's severe transgressions reflected poor behavior traits but the same transgressions committed by attractive children reflected isolated behavioral incidents. Raters also judged the unattractive children to be more dishonest and unpleasant than the attractive children who had performed the same behavior. Similarly, attractive children were rated as less likely to commit similar transgressions in the future.

Summary

Given a single viewing, attractive faces are liked more than unattractive faces, a pattern that applies to both adult and infant faces. There is a distinction between the initial valence regarding these types of faces: Attractive faces are perceived positively, whereas unattractive faces are perceived negatively. However, perceptions of faces may shift over time. Mere exposure theory makes predictions concerning changes in liking of stimuli over time. In the next section of this paper, theoretical and empirical work on mere exposure is reviewed.

Mere Exposure Effect

Overview of Literature

Zajonc's theory of mere exposure states that, given repeated exposure to any type of stimulus, an individual will increase his/her liking for the stimulus: "Mere repeated exposure of the individual to a stimulus is a sufficient condition for the enhancement of his attraction toward it," (Harrison & Zajonc, 1970). Zajonc's (1968) first evidence of the mere exposure effect was related to word exposure where he found that adjectives that appeared more frequently in written work were rated as more favorable than adjectives that appeared less frequently. Similarly, participants perceived words to mean something "better" if they had been exposed to them more often. This was true regardless of the word's meaning or content, and also true regardless of whether participants' exposure to the words had been visual or spoken (some participants simply saw the words, whereas others were asked to speak them aloud). Zajonc found that the exposure-frequency relationship did not require participants to be active in their exposure to the stimulus: passively looking at the stimulus for 2 seconds was enough to induce preference for it. Later work (Zajonc, 2001) indicated that even conscious awareness of the stimuli was unnecessary, and that frequently flashed subliminal exposures were experienced as preferable to subliminal exposures that were infrequently flashed.

The mere exposure effect has been confirmed for a number of different types of stimuli, including stimuli that are processed in different ways. Studies have found increased affective ratings for visual, auditory, and olfactory stimuli including paintings, music, words, and odors. For example, Harrison and Zajonc (1970), using Chinese ideographs as stimuli, found that affective ratings increased relative to the number of exposures. In their 1974 study, Heingartner and Hall played clips of Pakistani folk music 1, 2, 6, and 8 times and found that the musical selections were preferred if they had been heard more frequently. A more recent study has established that repeated odors are also preferred and judged as more pleasant than novel odors (Delplanque et al., 2009). Zajonc and colleagues (1972) found a slightly more complex relationship between exposure and liking when they used paintings as stimuli. For both initially liked and initially disliked paintings, the liking ratings were curvilinear showing that there was an initial increase in liking ratings, but after a certain threshold of exposures, the liking ratings declined.

Human Stimuli

Facial photographs. The mere exposure effect is also valid for facial stimuli. Moreland and Zajonc (1982) showed participants the same face once a week for four weeks, and found that familiarity with the face strongly influenced the participants' ratings of how much they liked the stimulus person, and how much they wanted to do a variety of activities with that person. Their attraction to the stimulus was not only greater than zero, but also greater than the scores given by participants who saw a different stimulus photograph each week. Their change in attraction to the repeated stimulus was positive and linear, and was unrelated to their perceived similarity to the stimulus person.

Using a wider range of faces (Chinese and Caucasian male and female faces), Rhodes, Halberstadt, and Brajkovich (2001) established that exposure increases liking ratings, regardless of the race or sex of the stimulus face.

The mere exposure effect can be used to look at responses to outgroup members, especially racial groups with whom the participants may not have had extensive contact. For example, using child participants from a racially homogeneous school, Cantor (1972) showed Caucasian children photographs of both familiarized and novel African-American children, and found that the Caucasian children rated familiarized African-American children more positively than novel African-American children.

Live human stimuli. The exposure effect holds not only for generalized liking but also for interpersonal interaction. When in conversation with a stranger, participants self-disclosed more about themselves, and were willing to answer more personal questions about themselves, when they were interviewed by a “frequently-seen other” (Brockner & Swap, 1976). They also showed a preference for affiliating with the person they were more frequently exposed to, and reported liking that person more than others.

Summary

Familiar stimuli are liked more and appraised more positively than unfamiliar stimuli, across different stimulus types and different measurements of behavioral outcomes. Increased liking based on exposure occurs for stimuli processed visually, aurally, and olfactorily and extends to evaluations of peers, whether the peers have been presented as photographic stimuli or in person. However, the increased liking effect has not been tested on faces that vary in facial attractiveness. I next review evidence concerning the breadth of stimuli that have been used to test mere exposure theory and outline the role of stimulus valence in predicting responses to human faces

EFFECTS OF STIMULI VALENCE

Zajonc's (1968) monograph on the mere exposure effect claims that the effect is valid for all types of stimuli, even those that are initially disliked. Therefore, exposure to any type or valence of stimulus should increase in favorability over time, at least initially. This has been confirmed by several of Zajonc’s own studies (e.g., Zajonc, Crandall, & Kail, 1974; Zajonc et al., 1972). For example, Zajonc (1972) reported that stimuli that were initially liked formed an inverted U pattern over multiple exposures. The stimuli that were initially disliked followed the same pattern, although they pattern occurs at a lower level on the liking scale. Even though there was a discrepancy between initial evaluations of the stimuli, the repeated exposure exerted the same influence (initially increasing liking ratings) on both stimuli categories. In a follow-up study, Zajonc, Markus, and Wilson, (1974) manipulated the context in which stimuli were presented, indicating that men in the photographs were either "famous scientists and scholars" or "men who have committed serious crimes." In this study, he found that the stimuli in the low-favorable condition increased in positive appraisals over exposures, but at a slower rate than the increase in the high-favorable condition. These studies indicate that despite differences in baseline responses to negative or unfamiliar stimuli, the pattern of mere exposure holds such that increased exposure promotes liking ratings and positive appraisals, up to a saturation point. Zajonc (1972) conceded that although the saturation point usually occurred after a large number of exposures, its onset could be determined by some unknown properties of the stimuli themselves. Perhaps the valence of the stimuli is one of these unknown properties, exerting differential influence on the stimuli.

Several researchers (e.g. Brickman, Redfield, Harrison, & Crandall, 1972; Grush, 1976) suggest that the pattern of heightened positive appraisal may not hold true for stimuli that are initially perceived to be negative. Rather than increasing liking for all stimuli, the mere exposure effect may depend on the initial valence of the stimuli or the original appraisal of the stimuli. Indeed, repeated exposure may intensify original negative evaluations of non-neutral or negative stimuli. Grush (1976) exposed participants to either positive or negative words. Participants perceived negative words significantly more negatively under high exposure conditions (10 or 25 exposures, as opposed to 1 or 2 exposures in the low exposure conditions). Brickman and colleagues (1972) exposed participants to musical stimuli and found that repeated exposure augmented favorability perceptions of initially positive and neutral stimuli, but that participants perceived initially negative stimuli as less favorable over repeated exposures.

Perlman and Oskamp (1971) experimentally varied the favorability of context and number of exposures to the stimuli. They found a difference in both the direction and effect size of changes in favorability ratings. More specifically, stimuli shown in positive contexts elicited a marked increase in favorability upon increasing numbers of exposures. However, stimuli portrayed in negative contexts shown over multiple exposures elicited a slight decrease in favorability ratings from the baseline.

According to Blanchette and Richards (2013), negative emotional stimuli are attended to more quickly, and may hold attention longer than neutral emotional stimuli. This is reflective of negativity bias, wherein negatively valenced stimuli produce stronger responses (cognitive, emotional, and physiological) than neutral or positive stimuli (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Cacioppo, Gardner, & Berntson, 1999; Crawford & Cacioppo, 2002). This may explain why stimuli that are negatively valenced, or are initially perceived negatively, do not seem to conform to the predictions of the mere exposure effect. Conversely, negatively valenced stimuli may require a larger number of exposures before they conform to the mere exposure effect, making increased liking ratings less likely to appear in studies where the number of exposures is relatively small.

It is currently unclear if unattractive faces would elicit responses that are similar to those elicited by other types of negatively valenced stimuli. Certainly unattractive faces have lower liking ratings upon initial viewing than attractive faces do, but would that necessarily make them "negative," and, if so, would they follow a pattern of decreasing liking responses over repeated exposure?

PERCEPTUAL FLUENCY

The ease and speed with which a stimulus is identified and processed, perceptual fluency (Bornstein & D'Agostino, 1994; Jacoby & Dallas, 1981; Posner & Keele, 1970;

Reed, 1972), may interact with exposure and lead to both increased positive affect and positive appraisals of stimuli. Stimulus familiarity, which may be augmented by increased exposure, is one factor that may influence the level of perceptual fluency.

Familiarity

Familiar stimuli are more fluently processed due to an ease perceiving, encoding, and processing the stimuli (Bornstein & D'Agostino, 1992; Bornstein & D'Agostino, 1994; Haber & Hershenson, 1965; Jacoby & Whitehouse, 1989). Conversely, low fluency is an indicator of stimulus novelty (Curran, 2000) or lack of familiarity. The relationship between familiarity and fluency may be a two-way process: fluency additionally triggers feelings of familiarity toward a stimulus (Whittlesea, 1993), even when the participant has not been previously exposed to the stimulus. Changing the context in which the stimulus is presented in ways that increase fluency lead participants to rate the stimuli as seeming more familiar (McGlothlin & Killen, 2010). However, positive stimuli (such as positive words and attractive faces) feel more familiar than neutral stimuli (Monin, 2003), indicating a potential bidirectionality of the liking effect with regard to familiarity.

Affect

Familiarity leads to enhanced perceptual fluency and more fluent processing facilitation. Enhancing fluency leads to more favorable judgments of the stimuli (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Increasing perceptual fluency may not only increase positive perceptions of the stimuli themselves, but also influence affective states. Reber and colleagues (1998) argue that fluency is in itself pleasant. Two studies experimentally manipulated fluency, making stimuli more fluent by exposing participants to them multiple times (Monahan, Murphy, & Zajonc, 2000; Zajonc, 2001). They found that increased levels of fluency augment overall mood and increase generalized positive affect.

Faces

Characteristics of attractive faces may lead participants to perceive them as more familiar and/or more typical than unattractive faces. There is a high correlation between perceived familiarity and attractiveness for adult female faces (Langlois, Roggman, & Musselman, 1994). Likewise, attractive faces are rated as less distinctive (Trujillo, Jankowitsch, & Langlois, 2014), more typical, less unusual, and more similar to each other (Light, Hollander, & Kayra-Stuart, 1981) than unattractive faces.

The perceived familiarity or typicality of stimuli faces leads to behavioral differences in participants indicative of increased perceptual fluency. For example, faces rated as highly typical are categorized as faces more quickly than less typical faces (Johnston & Ellis, 1995). Likewise, high-attractive faces are categorized as human more quickly than low attractive faces (Trujillo et al., 2014).

Summary

Perceptual fluency is influenced by the familiarity (perceived or real) of a stimulus. Previous research has found that stimuli that are more familiar are easier to process, making them both highly perceptually fluent and more likely to induce positive affect in the perceiver. Increased exposure to a stimulus should increase levels of familiarity. Given that attractive faces are perceived as being more familiar upon initial evaluation, they should elicit positive affect, especially after the participant has been exposed to them repeatedly. Low attractive faces elicit more effortful processing, due to their low perceived familiarity, so I would not expect them to elicit positive affective responses. I next review evidence for these claims from studies using electromyography.

Electromyography

Participants' affective responses to the target stimuli may be one of the mechanisms that cascade into the behavioral and attitudinal effects discussed in the previous sections.

Overview

One of the most robust psychophysiological measures is electromyography (EMG). Facial EMG captures subtle skeletal facial muscle movements that are associated with affective responses. EMG can be used to index emotional processing, reactions to specific stimuli, or the intensity of self-induced emotions.

Muscle activity can occur and be measured by facial EMG even when participants are unaware of the specific facial expression they are making (Dimberg, Thunberg, & Elmehed, 2000). Additionally, EMG can detect subtle affective reactions to stimuli that do not elicit fully developed emotional expressions (Cacioppo, Bush, & Tassinary, 1992; Dimberg et al., 2000; Tassinary & Cacioppo, 1992). Previous research in emotion cognition shows that affective responses can be processed prior to self-conscious awareness of the emotion or explicit identification of the stimulus (LeDoux, 2003).

Recording EMGs is non-invasive and painless (de Wied, van Boxtel, Zaalberg, Goudena, & Matthys, 2006; Garrity & Donoghue, 1977). Cacioppo and colleagues (1986) found that facial EMG yields reliable information about both the valence and the intensity of emotional reactions to stimuli. One advantage of EMG is that it captures affective reactions to stimuli that participants might be reticent to admit, such as certain types of bias.

Activity of the cheek, nostril, and brow muscles is correlated with positive and negative affective responses and indications of liking, including self-reports (Larsen, Norris, & Cacioppo, 2003). The *corrugator supercilii* (CS; knitting the brow) and *levator labii superioris* (LLS; raising the nostrils) are associated with negative affect, while the *zygomaticus major* (ZM; pulling the corner of lips into a smile) is associated with positive affect.

Facial Attractiveness

Some studies have shown that EMG response is a stronger predictor of biased behavior than other measures of explicit or implicit bias (e.g., Stewart et al., 2013; Vanman, Saltz, Nathan, & Warren, 2004). This makes EMG a powerful technique for studying biases related to facial attractiveness. Specifically, attractiveness effects have been found in the activation of the ZM and unattractiveness effects in the activation of the CS and LLS (Gerger, Leder, Tinio, & Schacht, 2011; Principe & Langlois, 2011; Schein & Langlois, 2015).

Principe and Langlois (2011) found that, upon a single viewing, unattractive adult male and female faces elicited significantly more LLS (disgust) responses, whereas attractive faces elicited significantly less knitted eyebrow movement (CS, a negative affective response). A similar pattern appears when infant face stimuli are used: Unattractive infant faces elicited more LLS and CS movement in adult participants, indicating that negative affect may be driving participants' responses (Schein & Langlois, 2015). It is unclear whether increased exposure to unattractive infant faces would increase or decrease participants' psychophysiological and self-reported affective responses to those faces.

With the exception of Vanman and colleagues (2004), who studied race rather than attractiveness, EMG studies have not used self-report ratings to measure affect in conjunction with psychophysiological measures. Likewise, self-report studies have not used psychophysiological measures to confirm the affective component of their research.

THE PRESENT STUDY

The primary aim of this study is to determine the trajectory of self-reported liking ratings and psychophysiological affective responses to attractive and unattractive infant stimuli over multiple exposures. This is both a methodological and theoretical question: previous research has not established whether psychophysiological responses to faces might change as exposure has increased, and has not established whether the mere exposure effect applies to unattractive faces.

According to negativity bias theory, exposure effects depend on the initial valence of stimuli, so I would expect to see divergent responses to attractive and unattractive faces. Because attractive faces lead to positive affect, unattractive faces lead to negative affect, and positive and negative affect are independent from one another (Harmon-Jones & Allen, 2001; Watson, Clark, & Tellegen, 1988), it is reasonable to make separate predictions for each type of facial stimulus.

However, mere exposure theory would predict that positive affective responses and self-reports of liking would both increase as participants are exposed to the stimuli more, regardless of their initial appraisals of the stimuli. In other words, Zajonc would predict that participants would be increasingly interested in both attractive and unattractive facial stimuli (at least through 25 exposures, the maximum number used in his studies). However, this theory fails to account for the ugly-is-bad stereotype, the increased effort expended in order to process faces that are perceived as less familiar, and the initial negative affective reactions that participants have in response to unattractive faces.

I hypothesize that positive affective responses to attractive faces and negative affective responses to unattractive faces will follow independent trajectories: Concordant with the mere exposure theory, participants will have initially positive affective responses to attractive faces that increase over repeated exposures before a plateau. Conversely, participants will have negative affective reactions to unattractive faces that grow progressively more negative over a small set of repeated exposures. The combination of low perceptual fluency, low perceived familiarity, and negative stereotypes about unattractive faces mean that the predictions made by the mere exposure theory may not apply to unattractive faces.

Summary

Because attractive faces elicit both higher ratings of liking and may elicit increased ZM activation (Langlois et al., 2000; Principe & Langlois, 2011; Schein & Langlois, 2015), attractive faces should induce positive affect from the onset, and positive affect should continue to increase over multiple exposures. Conversely, the initial negative valence of unattractive faces should lead to a period of negative affective response toward the unattractive face, evidenced through both a decrease in self-reports of liking and through an increase in LLS and CS responses.

Chapter 2: Method

PARTICIPANTS

70 undergraduates (*M*= 20.88 years old, *SD*= 1.51 years; 36 female) were recruited through their Introductory Psychology course and received course credit in exchange for their participation, or were recruited through the community and received $10 in compensation. The community participants were recruited through Craigslist, the UT Events calendar, and flyers on the UT campus. Though they were recruited differently from the Introductory Psychology students, the majority of the community participants were UT undergraduates.

I excluded data from analysis for 3 participants due to equipment malfunction. The final sample included 67 participants (34 female) and included 25% Caucasian, 30% Asian/Asian-American, 30% Hispanic/Latino, and 16% African-American participants.

STIMULI

Stimuli were images of six attractive and six unattractive Caucasian 10-month-old infants with neutral facial expressions. Stimuli were standardized for color and blur levels, and cropped and occluded so that only the infant's head/face was visible. Each face was presented against a white background.

These stimuli were previously rated for attractiveness on a 7-point scale by 40 participants (20 male, 20 female undergraduate students; 37.5% Asian, 25.0% White, 20% Hispanic/Latino, 12.5% mixed-race, and 7.5% African-American). The attractive (M = 4.83, SD = 0.18) and unattractive (M = 2.65, SD = .15) stimuli groups were significantly different, $t(5) = 58.00$, $p < .001$.

PROCEDURE

The experimenter explained to participants that we would be measuring their psychophysiological responses to photographs of infants. Participants sat in front of a computer and the experimenter attached seven Ag-AgCl electrodes filled with conductive gel to the participant's face. The experimenter placed electrodes over the *corrugator supercilii* (brow muscle) and the *levator labii superioris* (nostril muscle) to measure negative affective correlates, and the *zygomaticus major* (cheek muscle) to measure positive affective correlates, and at the top of the forehead as a control site, using the guidelines developed by Fridlund and Cacioppo (1986).

Participants viewed a series of images of faces presented one at a time on a computer monitor. The computer displayed each image for 2,000 ms, with 3,000 ms ISI. The entire stimuli set was shown in random order for each set of 25 exposures so that there was one block of randomized stimuli presented 25 times (Brickman et al., 1972; Grush, 1976; Harrison & Zajonc, 1970; Zajonc et al., 1972).

DATA CODING AND DEPENDENT VARIABLES

Facial muscle movement. The dependent measure was facial muscle activity, as reflected by wave amplitude measured in microvolts (mV). I used a 500Hz passband to filter the data to remove artifact and amplifier noise (Fridlund & Cacioppo, 1986; Principe & Langlois, 2011). I averaged across each of the two electrodes attached to each site of interest. The sites of interest are the CS (negative affect), LLS (negative affect), and ZM (positive affect) (Fridlund & Cacioppo, 1986).

I averaged the amplitude of the waveform for the 2,000ms of stimuli observation for each electrode site and subtracted the baseline, which is the average amplitude for the 2,000ms immediately preceding stimuli onset for that site. This number indicates the average muscular reaction to each infant face for each presentation. It is a "change" score, so it represents the experimental response to the stimulus (in this case, the infant's face) by controlling for general differences in baseline affectivity across participants.

Liking ratings. On the computer, participants rated how much they liked each baby immediately after viewing its face each time on a scale of 1 to 7, with 1 being *do not like at all*, 4 being *neither like nor dislike*, and 7 being *like very much*. This provided an explicit rating of preference for the infants.

Chapter 3: Results

Overview

To control for individual participants' variation in baseline size of facial muscle movements, as well as individual variation in responsive facial muscle movements (i.e. the possibility that some participants would react more strongly to the differences in stimuli attractiveness than others), I analyzed the data using Hierarchical Linear Modeling. I treated attractiveness and exposure as fixed factors and participant as a random factor. Dependent variables were self-reported liking ratings, CS movement, LLS movement, and ZM movement.

Rather than dichotomize the attractiveness variable by dummy coding the unattractive and attractive stimuli, I used the continuous ratings of attractiveness that I had collected from an independent set of raters. Thus, the unattractive and attractive groups are not collapsed across exposure, but rather each individual data point is represented in the analysis, which contributes to the high number of degrees of freedom.

Additionally, I conducted analyses to control participant race. Previous research has indicated that the gender and race of the rater do not significantly affect judgments related to stimuli attractiveness, but those studies have not included exposure as an independent variable (Langlois et al., 2000).

For all of the following models, the random effects structure dictated that the model use both random intercepts and slopes.

Liking Ratings

There was a significant fixed-effects interaction between attractiveness and exposure, b=.0009, $t(20030)=7.870$, $p < .001$. This interaction showed that participants liked attractive faces more as exposure increased (M=4.82 upon first exposure, M=4.94

upon twenty-fifth exposure) and liked unattractive faces less as exposure increased (M=3.06 upon first exposure, M=2.73 upon twenty-fifth exposure). See Figure 1.

PHYSIOLOGICAL RESPONSES

Corrugator Supercilli

There was no significant interaction to predict CS movement based on the interaction between exposure and attractiveness, b=.0002, t(20030)=.718, p=.473.

I found evidence of electrode cross-talk between the *levator labii superioris* and the *zygomaticus major* (see similar findings in Principe & Langlois, 2011; Schein & Langlois, 2015; Vrana, 1993), meaning that because of the muscles' proximity to one another, interference from the neighbor muscle obscured the true relationship between attractiveness and the target muscle. To remedy this, I constructed models controlling for the movement of the neighbor muscle.

Levator Labii Superioris

To control for electrode cross-talk and examine LLS independently of the influence of ZM, I regressed ZM on LLS, and used the residuals as the outcome in an HLM model predicting LLS from infant attractiveness and exposure. This model did not significantly predict LLS movement based on an interaction between exposure and attractiveness, b=.0002, t(20030)=.699, p=.484.

Removing the non-significant interaction effect revealed a significant main effect of exposure on LLS movement, b=.0007, t(20032)=2.106, p=.035. This indicates that over the course of the experiment, participants showed more negative affect, regardless of stimulus type.

Zygomaticus Major

For ZM, I utilized the same technique I had used for LLS, controlling for electrode-cross talk by using participants' residualized scores in the analysis, thus stripping away the influence of LLS movement from ZM movement. This model indicated a significant interaction between attractiveness and exposure, b=.001, $t(20030)$= 2.857, p= .004, indicating an initial ZM response to the unattractive infant faces, followed by a steep decline in ZM response over the course of the 25 exposures, but no change over time for the attractive infant stimuli. See Figure 2.

PARTICIPANT RACE

Overall

Given that our stimuli were all Caucasian and our participants were largely non-Caucasian, I added participant race to the previous analyses to control for the possibility of differential responses to the stimuli driven by own-race liking effects. Since there were multiple races of participants in the study, and the stimuli were Caucasian, I dummy coded participant race as either Caucasian or non-Caucasian. None of the dependent variables (self-reported liking, CS, LLS, and ZM) were significantly predicted by three-way interactions that included participant race, exposure, and infant stimuli attractiveness (p>.05 for all three-way interactions).

Liking ratings

The only significant effect was that overall, Caucasian participants liked the infant stimuli more than non-Caucasian participants, b=.059, $t(20031)$= 3.313, p<.001. Caucasian participants rated the unattractive infants 3.05 on the self-reported liking scale (non-Caucasian participants rated them 2.83) and rated the attractive infants

4.94 (non-Caucasian participants rated them 4.85). However, this finding is only statistically significant if exposure is not included in the model.

Using the AIC, a standard measure of model fit, the best model to predict self-reported liking ratings includes only the fixed effects of infant attractiveness and exposure. In other words, adding participant race to the model actually decreases its effectiveness in describing the data; therefore, participant race should not be included in the model.

SUMMARY

There was a significant fixed-effects interaction of attractiveness and exposure on self-reported liking ratings, showing that liking of attractive infants increased with more exposure, and liking of unattractive infants decreased with more exposure. There was also a significant fixed-effects interaction of attractiveness and exposure on ZM response, showing that participants displayed initial ZM movement toward unattractive infants, which declined with increased exposure. Participant race did not significantly predict any of the dependent variables when combined with infant stimuli attractiveness and exposure.

Chapter 4: Discussion

Overview

The purpose of this study was to investigate the effects of exposure to attractive and unattractive infant faces on participants' self-reported liking ratings and psychophysiological responses. Mere exposure theory indicates that exposure to any stimulus will increase positive affect toward that stimulus, however the present study found that this is untrue when the stimulus is an unattractive infant. This aligns with previous research indicating that negatively-valenced stimuli may not conform to the predictions of the mere exposure theory, and with research from the attractiveness literature indicating that negative perceptions of unattractive targets drive differential treatment.

Liking Ratings

In this study, I found an overall decrease in self-reported liking ratings to unattractive infants over the course of 25 exposures. This co-occurred with an increase in self-reported liking ratings toward attractive infants over the course of 25 exposures. These findings indicate that repeated exposure to unattractive infant faces may intensify original negative evaluations of those faces, while repeated exposure to attractive infant faces may intensify the original positive evaluations of those faces.

The decline in liking ratings of unattractive infants does not conform to predictions of mere exposure theory, which state that repeated exposure to any stimulus will increase liking toward that stimulus (Zajonc, 1968). This outcome adds to the body of literature indicating that the mere exposure theory may not apply to negatively-valenced stimuli (Brickman, Redfield, Harrison, & Crandall, 1972; Grush, 1976; Perlman & Oskamp, 1971). When stimuli are initially evaluated as negative, negativity bias rather than mere exposure theory better predicts the effects of repeated exposure (Blanchette & Richards, 2013).

Zebrowitz and Rhodes' (2004) "bad genes" hypothesis postulates that facial attractiveness is related to genetic fitness, and thus unattractive facial features indicate maladaptive traits such as low intelligence and health. Relatedly, the anomalous face overgeneralization hypothesis posits that individuals overgeneralize their negative assumptions about targets with less attractive faces, assuming that the targets are similar to those who are unfit. Thus, it would be more evolutionarily adaptive to erroneously overgeneralize poor traits to unattractive individuals than to select those with anomalies whose health and intelligence is indeed lower than optimal. This leads raters to respond negatively to faces on the lower half of the attractiveness spectrum, even though their genetic fitness is not impaired.

Longitudinal data indicate that attractiveness is not related to current or future health, but that attractiveness is reliably and inaccurately used as a cue to advertise health (Kalick, Zebrowitz, Langlois, & Johnson, 1998). Mistaking unattractiveness for poor evolutionary fitness and overgeneralizing this to any target below average attractiveness provides a potential explanation for why participants' negativity bias is cued by unattractive infant faces. This is also consistent with the "ugly-is-bad" stereotype (Dion, 1972, 1974; Ritter, Casey, & Langlois, 1991; Schein & Langlois, 2015; Stephan & Langlois, 1984), wherein perceivers attribute negative traits to individuals who deviate from the normative attractiveness standard.

Participants' initial negative responses to the unattractive infants may be activated because they assume the unattractive infants to be genetically unfit or inherently "bad" in some way, and repeated exposure to those stimuli serves to confirm their initial assumptions, thus explaining the intensification of negative responses toward the unattractive infants.

PHYSIOLOGICAL RESPONSES

Levator Labii Superioris

There was no physiological differentiation in responses to attractive and unattractive stimuli in the LLS, but rather saw an overall increase in negative physiological (LLS) response over increasing exposure to the stimuli. The overall negative response may indicate participants' irritation with the duration and repetitiveness of the study.

Zygomaticus Major

I found an interaction between exposure and attractiveness on ZM response. This finding is surprising, given that previous studies exploring EMG responses to attractive and unattractive facial stimuli have not found significant ZM effects (e.g., Principe & Langlois, 2011; Schein & Langlois, 2015). However, there is evidence that after several exposures, this positive affective response to unattractive infants disappears entirely, and even becomes negative, meaning that participants' responses to baseline, i.e., their physiological resposnses to viewing a blank screen, elicit more ZM response than their responses to the stimuli themselves.

Previously, Harmon-Jones and Allen (2001) found increased ZM responses to familiar (rather than unfamiliar) facial stimuli, but those stimuli were neutral in valence and not rated for attractiveness. Generally, greater perceptual fluency, i.e., more familiarity or perceived familiarity, increases ZM responses, so finding heightened ZM response toward stimuli that are both unfamiliar (because they have never been seen before) and have low perceived familiarity (because they are unattractive) was unexpected.

ZM response is used in EMG studies of bias to indicate a physiological positive affective response to a stimulus. However, this is not the only potential interpretation of ZM movement. Elements of smiling behavior can be associated with several types of emotional responses, including amusement/joy, embarrassment/nervousness, and politeness (Ambadar, Cohn, & Reed, 2009). Embarrassed smiles are especially difficult to classify in terms of discrete muscle movement or facial behavior (Haidt & Keltner, 1999; Harris & Alvarado, 2005), and cannot be easily classified as separate from amused or polite smile movement, thus a portion of our ZM outcomes may be explained by the prevalence of these embarrassed smiles.

Anecdotally, several of the participants appeared to be laughing at the unattractive infant stimuli, perhaps out of surprise because they do not expect infants to be unattractive: The Gerber baby is regarded as a prototypical infant face, and is highly attractive. Participants may not have experience with a wide range of infant faces, and thus have a narrow idea of what to expect an infant to look like. They may also laugh because unattractive individuals are expected to be funny to compensate for their lack of physical appeal: Consider the movie trope where the protagonist has a funny, unattractive best friend.

One study has also found that smiling is related to self-reported negative affective responses to distressing stimuli, but more positive affect following the stimuli (Ansfield, 2007), which is consistent with the theory that smiling can be used to improve mood in response to unpleasant situations (Keltner & Bonanno, 1997). Results from these previous studies may help explain the ZM response to unattractive infants in the present study: participants may be smiling as a nervous/embarrassed reaction to the unattractive infants, which abates over time, or they may be smiling as a means to protect their mood against the potentially negative emotional effects of repeatedly encountering photographs of unattractive infants.

USING ELECTROMYOGRAPHY TO EXAMINE EXPOSURE EFFECTS

Previous studies utilizing electromyography have employed it in order to examine responses to a single viewing of a stimulus, and have not attempted to examine changes in physiological response over time. The unexpected ZM finding in the present study, coupled with the lack of physiological discrimination after the first several exposures from any electrode site, indicate that electromyography may not be an ideal methodology to measure physiological affective responses over a longer span of time/exposures. It may also indicate that affective responses to specific stimuli may be short lasting and disappear after initial appraisals of the stimuli.

In the present study, I found that the self-report data yielded the strongest result: The more conscious, cognitive element of the stimulus appraisal is what changed dramatically over time. One explanation is that the affective and cognitive components of biased response co-occur, but the facial muscles measured using electromyography only respond to the first viewing of a stimulus, and are insensitive to further exposure. Another potential explanation is that the affective component cues the cognitive component of participants' responses. One study found that racial bias decreased if participants were forced to smile while viewing Black faces (Ito, Chiao, Devine, Lorig, & Cacioppo, 2006), which indicates that the initial affective response does in fact play a role in determining biased behavior, perhaps because the smiling facial muscle movement initiates a positive cognitive response.

General Discussion

Studies with clinical samples frequently use exposure as a means to treat anxiety disorders, obsessive-compulsive disorder, and post-traumatic stress disorder with successful results (e.g., Deacon & Abramowitz, 2004; Ougrin, 2011; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). The results of this study suggest that using increased exposure in a similar way would likely backfire by increasing overall negative appraisals of the "negative," or unattractive, stimuli, rather than leading increased familiarity to decrease negative responses.

Interventions targeting the cognitive component of the bias may be more effective, as evidenced by several studies wherein awareness of bias led participants to consciously attempt to decrease their bias. Internal motivation to decrease prejudice leads to active work on the part of a participant to eliminate their own prejudice, whether or not the prejudice is apparent to others (Plant & Devine, 2009), but in order for people to be motivated to decrease prejudice, they have to be aware that it exists and manifests in their behavior. Concern about discrimination, personal awareness of bias (Devine, Forscher, Austin, & Cox, 2012), and guilt surrounding bias (Amodio, Devine, & Harmon-Jones, 2007) have helped to decrease discrimination caused by implicit bias, and would likely serve the same function to decrease implicit bias surrounding appearance.

Future Directions

In addition to familiarity, prototypicality is a stimulus characteristic that contributes to perceptual fluency and increases liking for many different types of stimuli, even when the stimuli are very simple. Perceivers judge dot patterns and geometric shapes as more attractive and categorize them more rapidly when they are closest to the prototype (Posner & Keele, 1968; Winkielman, Halberstadt, Fazendeiro, & Catty, 2006). Future studies should explore the effects of manipulating prototypicality rather than familiarity as an alternative measure of perceptual fluency. If attractive faces are preferred because they are prototypical, they should be more quickly and easily processed than less attractive faces, and this should lead to greater positive affective responses. Previous research has shown that facial attractiveness increases the speed and accuracy of face identification and classification (Hoss, Ramsey, Griffin, & Langlois, 2005; Trujillo, Jankowitsch, & Langlois, 2014) but has not examined how this might interact with affective responses over time.

The stimuli in the present study were equally distributed between attractive and unattractive stimuli. However, the proportion of attractive versus unattractive faces may play a role in the perceived familiarity of the stimuli and the perceived distinctiveness of the stimuli. Perhaps if there were fewer unattractive stimuli presented, those unattractive faces would be perceived as more divergent from the overall stimuli set, and thus responded to more negatively.

Future studies should also explore the influence of race on attractiveness bias. The intersection of racial bias and appearance bias is vastly understudied, given the evidence that both biases are strong and pervasive (Rennels & Langlois, 2014). It would be useful to understand whether attractiveness serves as a protective buffer against racial bias, as well as whether being unattractive compounds the effects of racial bias.

Conclusion

A combination of negative valence of unattractive infant stimuli, initial low perceived familiarity of unattractive faces, and the ugly-is-bad stereotype may explain why unattractive infant faces do not conform to the mere exposure theory, but rather become more disliked as participants are increasingly exposed to them.

It is important to understand the affective mechanism driving differential liking preferences toward attractive and unattractive adult and infant faces, especially as it relates to repeated exposures to the face. These affective responses may have ramifications reflected through behavior toward the individual, resulting in differences between attractive and unattractive individuals ranging from salary (Hamermesh, 2011) to self-esteem (Langlois et al., 2000).

Figures

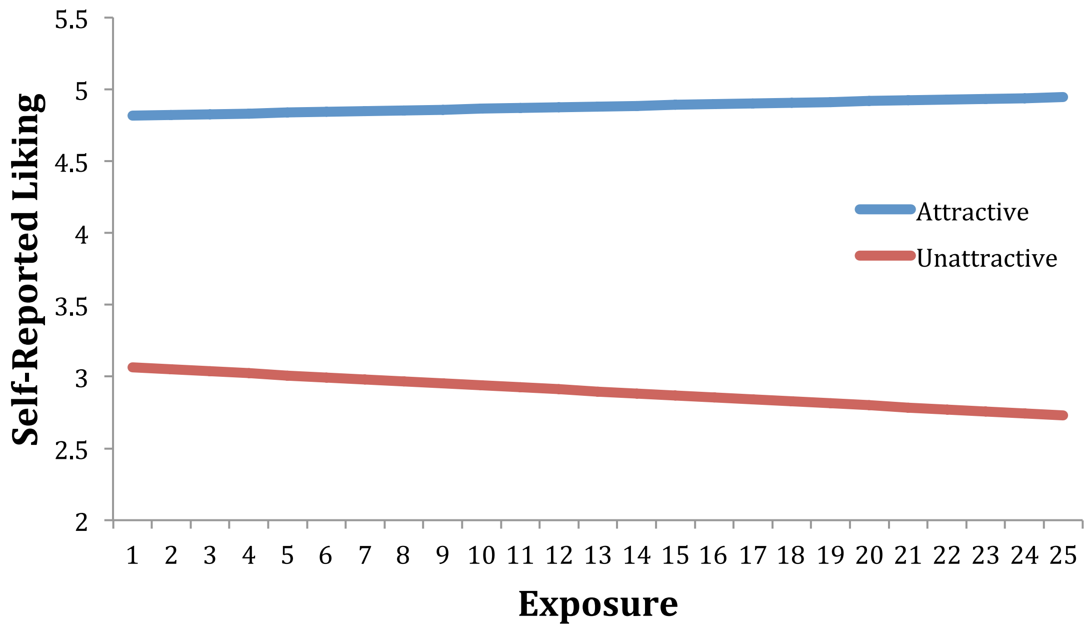

Figure 1. Self-reported liking ratings as a function of exposure and infant attractiveness.

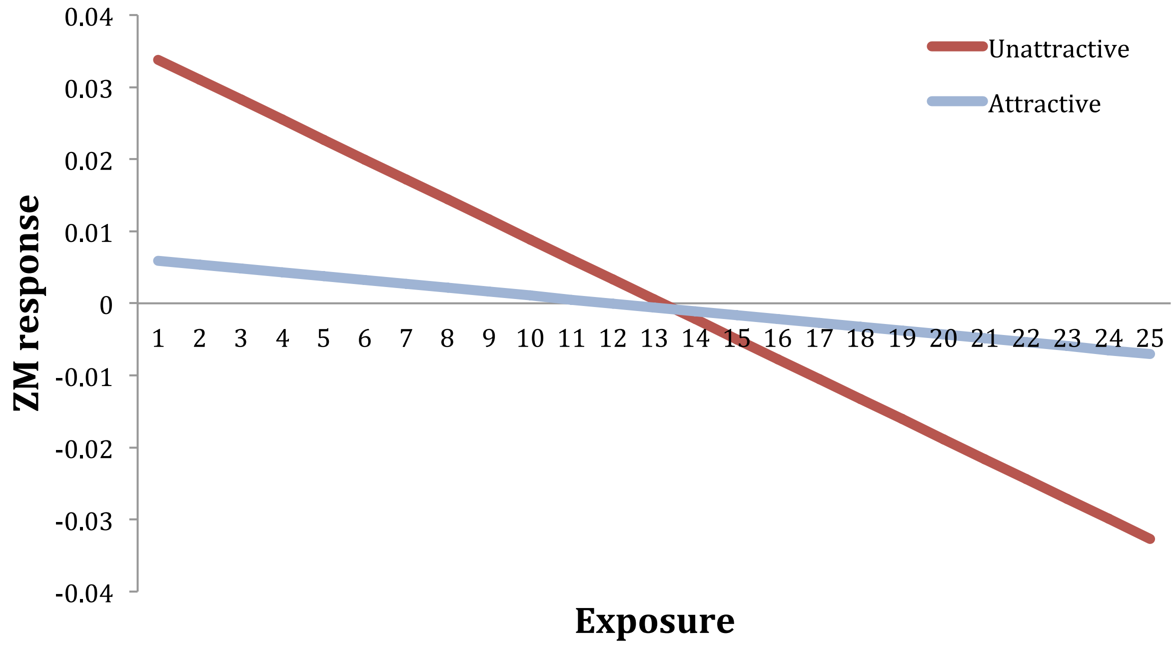

Figure 2. ZM response as a function of exposure and infant attractiveness.

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